US009054432B2

(12) **United States Patent**
Yang

(10) **Patent No.: US 9,054,432 B2**
(45) **Date of Patent: Jun. 9, 2015**

(54) **TERMINAL PLATE SET AND ELECTRIC CONNECTOR INCLUDING THE SAME**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 51 days.

(21) Appl. No.: **14/044,292**

(22) Filed: **Oct. 2, 2013**

(65) **Prior Publication Data**

US 2015/0093939 A1 Apr. 2, 2015

(51) **Int. Cl.**
H01R 9/24 (2006.01)
H01R 13/02 (2006.01)

(52) **U.S. Cl.**
CPC . ***H01R 9/24*** (2013.01); ***H01R 13/02*** (2013.01)

(58) **Field of Classification Search**
USPC 439/626, 660, 638, 79, 607.18
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,993,259 A * 11/1999 Stokoe et al. 439/607.09
6,171,115 B1 * 1/2001 Mickievicz et al. 439/76.1
6,293,827 B1 * 9/2001 Stokoe 439/607.07
6,431,914 B1 * 8/2002 Billman 439/607.07
6,633,490 B2 * 10/2003 Centola et al. 361/785
6,638,079 B1 * 10/2003 Billman et al. 439/76.1
6,848,917 B2 * 2/2005 Lang et al. 439/79
6,884,117 B2 * 4/2005 Korsunsky et al. 439/607.11
6,969,280 B2 * 11/2005 Chien et al. 439/607.13
7,097,506 B2 * 8/2006 Nakada 439/607.39
7,175,446 B2 * 2/2007 Bright et al. 439/79
7,195,497 B2 * 3/2007 Hull et al. 439/79
7,195,519 B1 * 3/2007 McAlonis et al. 439/607.39
7,270,574 B1 * 9/2007 Ngo 439/607.39
7,320,621 B2 * 1/2008 Laurx et al. 439/607.11
7,347,740 B2 * 3/2008 Minich 439/736
7,651,337 B2 * 1/2010 McNamara 439/65
7,931,474 B2 * 4/2011 Laurx et al. 439/65
8,226,441 B2 * 7/2012 Regnier et al. 439/626
8,267,721 B2 * 9/2012 Minich 439/607.05
8,540,525 B2 * 9/2013 Regnier et al. 439/79
8,591,260 B2 * 11/2013 Davis et al. 439/607.55
8,616,919 B2 * 12/2013 Stoner 439/607.07
8,734,187 B2 * 5/2014 De Geest et al. 439/626
8,747,158 B2 * 6/2014 Szczesny et al. 439/607.07
2002/0168898 A1 * 11/2002 Billman et al. 439/608
2006/0068640 A1 * 3/2006 Gailus 439/608
2006/0189212 A1 * 8/2006 Avery et al. 439/608

* cited by examiner

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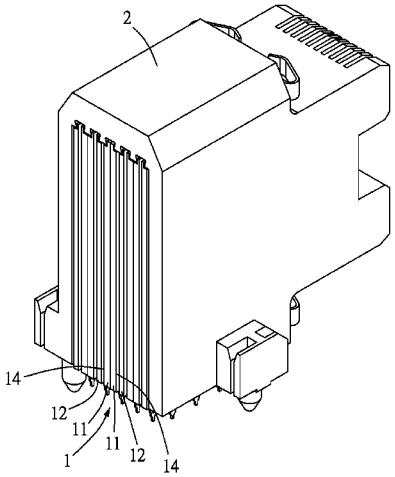
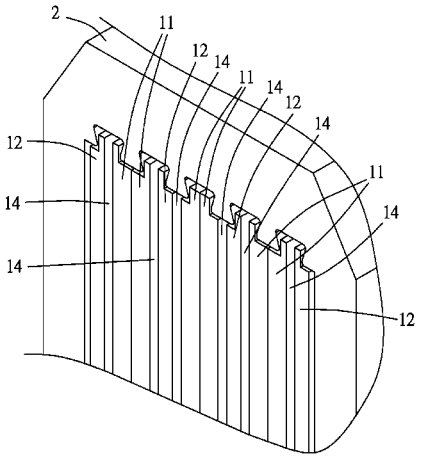
(57) **ABSTRACT**

A terminal plate set and an electric connector including the terminal plate set are disclosed. The terminal plate set includes two signal terminal plates and two grounding terminal plates, and the signal terminal plates are parallel to each other and disposed between the grounding terminal plates. A partition channel is formed between the grounding terminal plates, between the signal terminal plates, between the signal terminal plate and the grounding terminal plate, or between the terminal plates. The electric connector includes the terminal plate set and a front body, and the terminal plate set is installed at the front body, and a front convection hole is formed on a plug side of the front body. The impedance of the signal terminal plates and the grounding terminal plates can be adjusted within the best range to improve the heat dissipation efficiency of the terminal plate set and the electric connector.

6 Claims, 12 Drawing Sheets





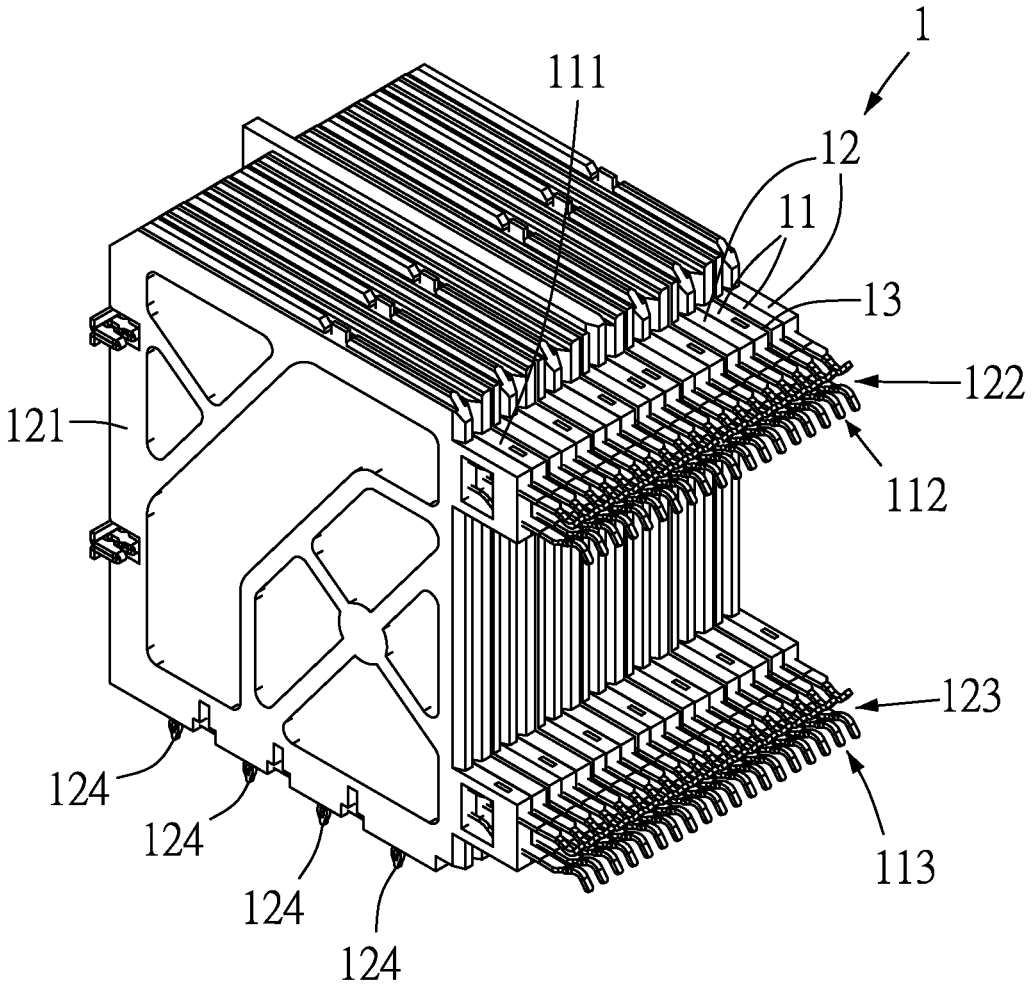


FIG.1

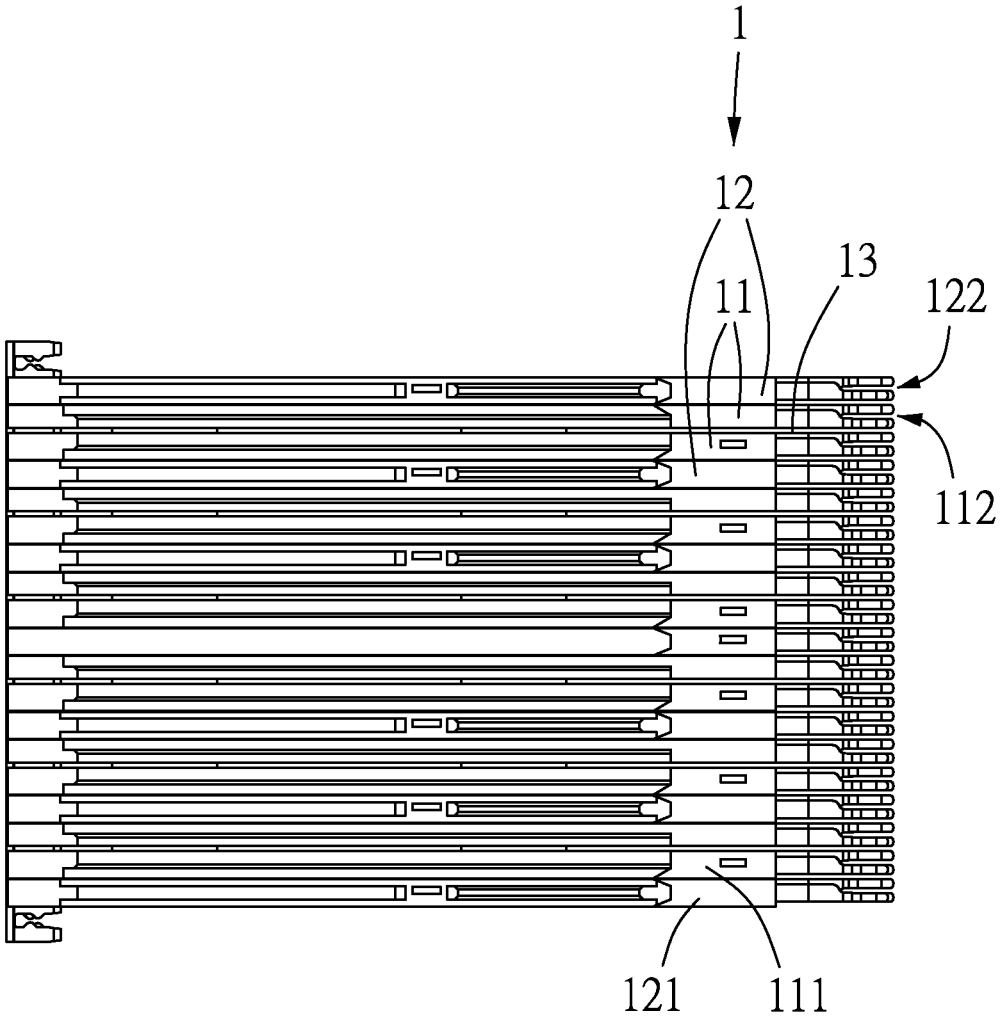


FIG.2

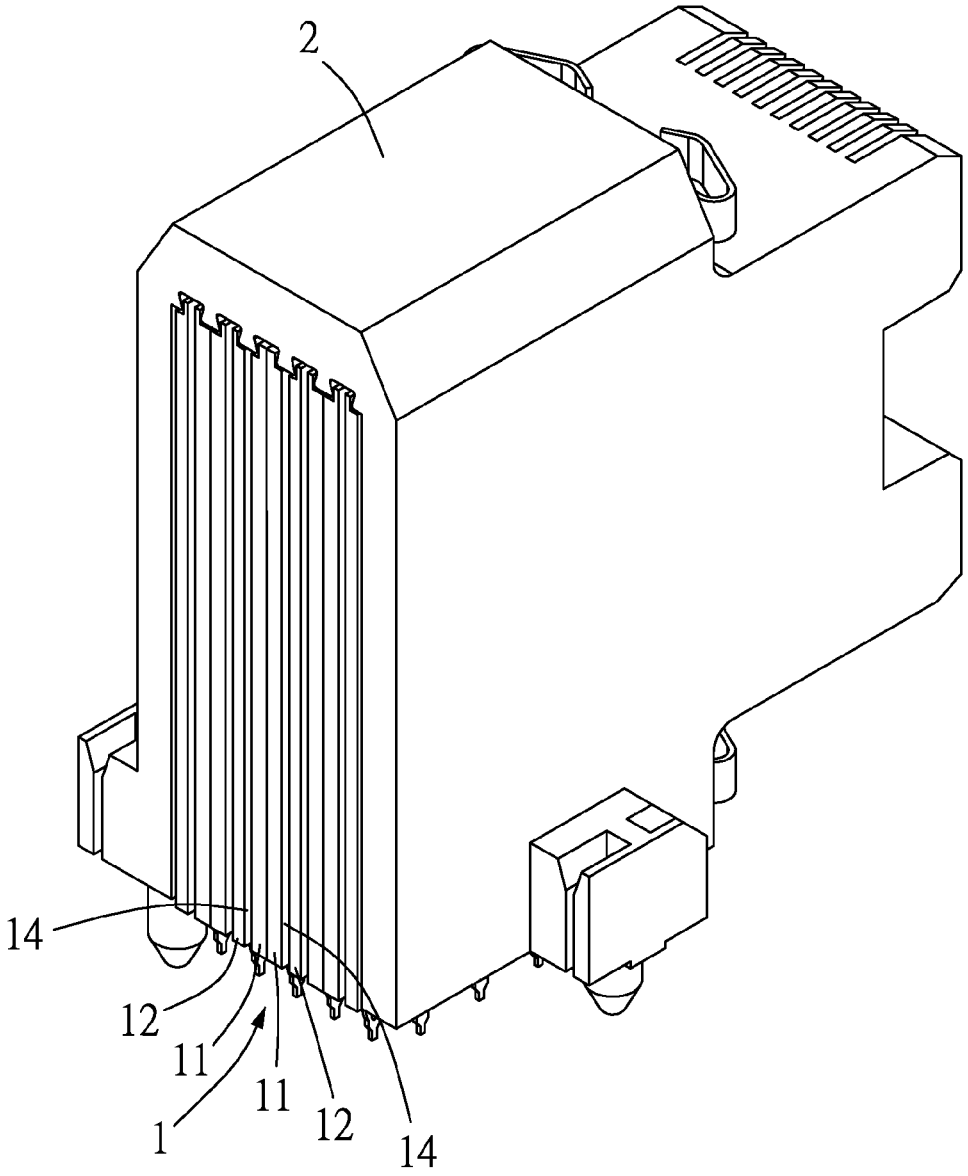


FIG.3

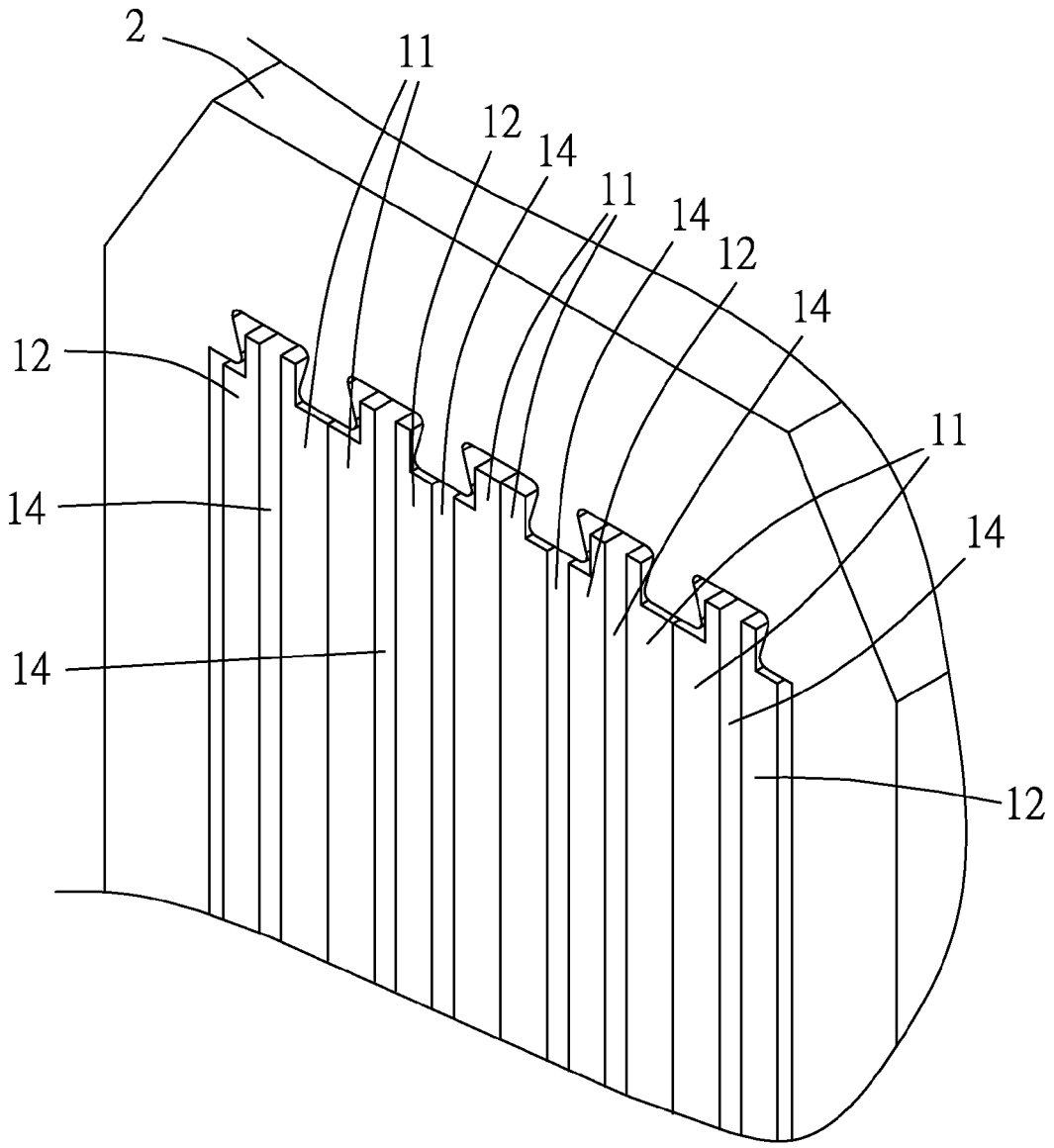


FIG.4

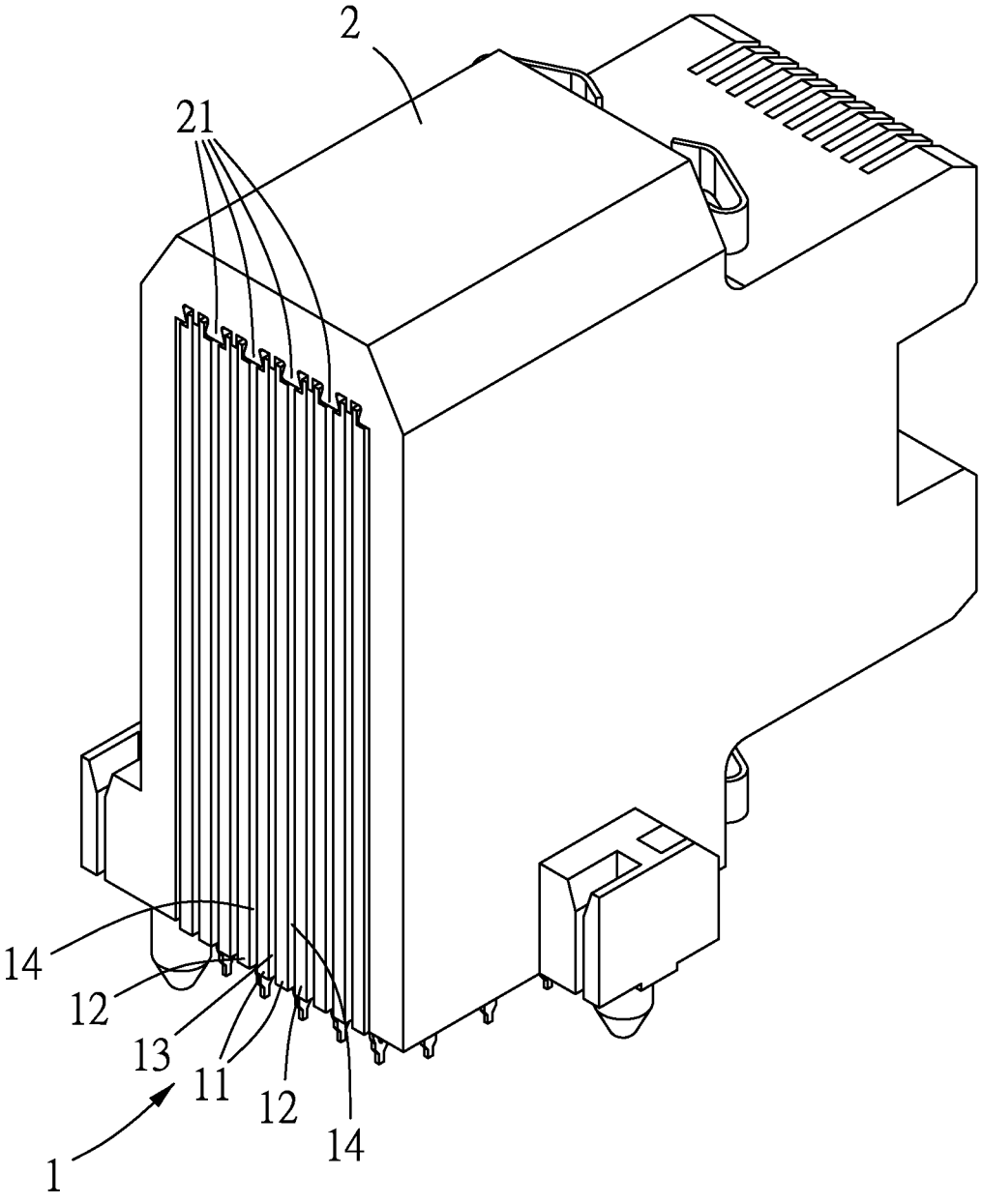


FIG.5

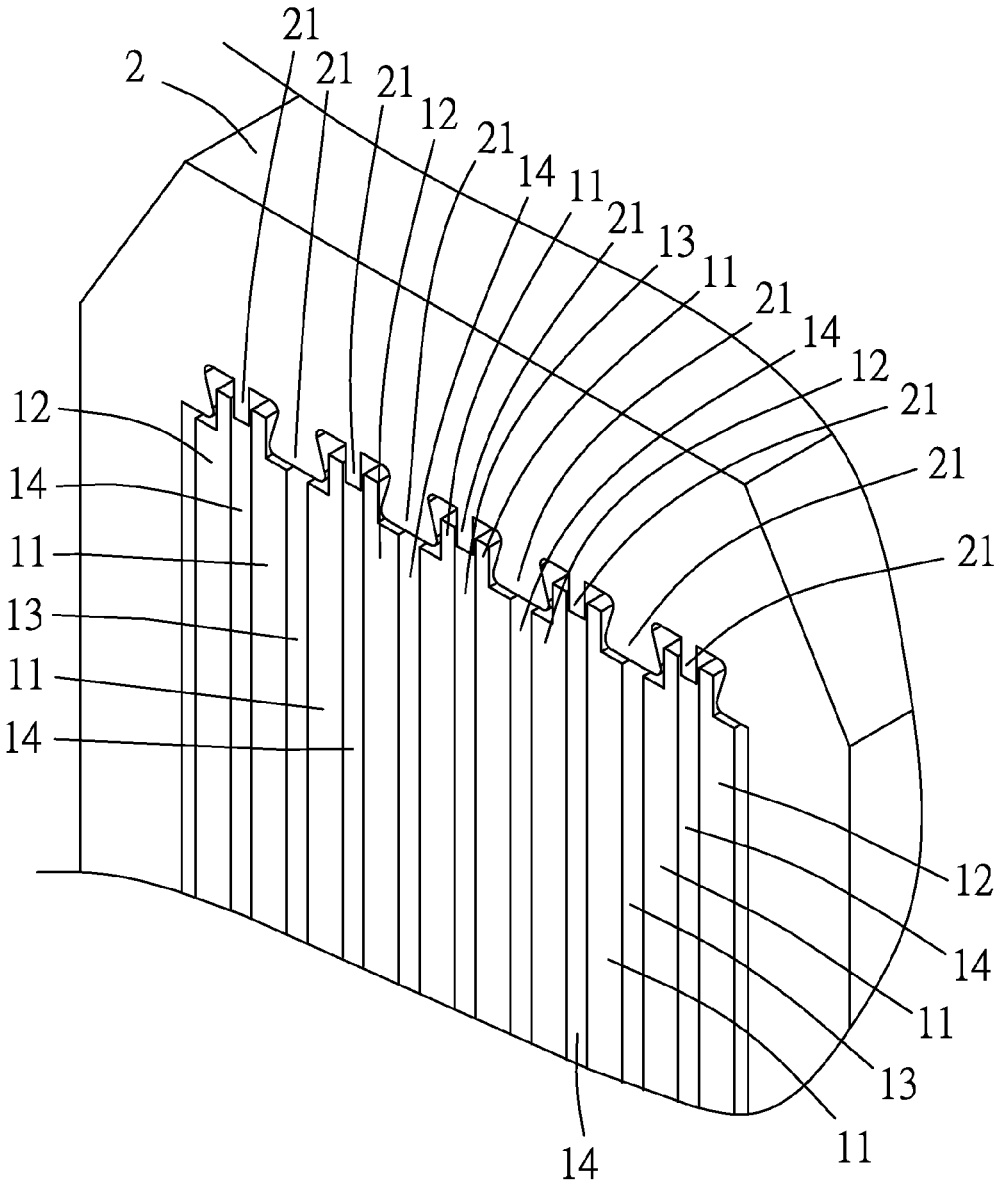

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FIG.6

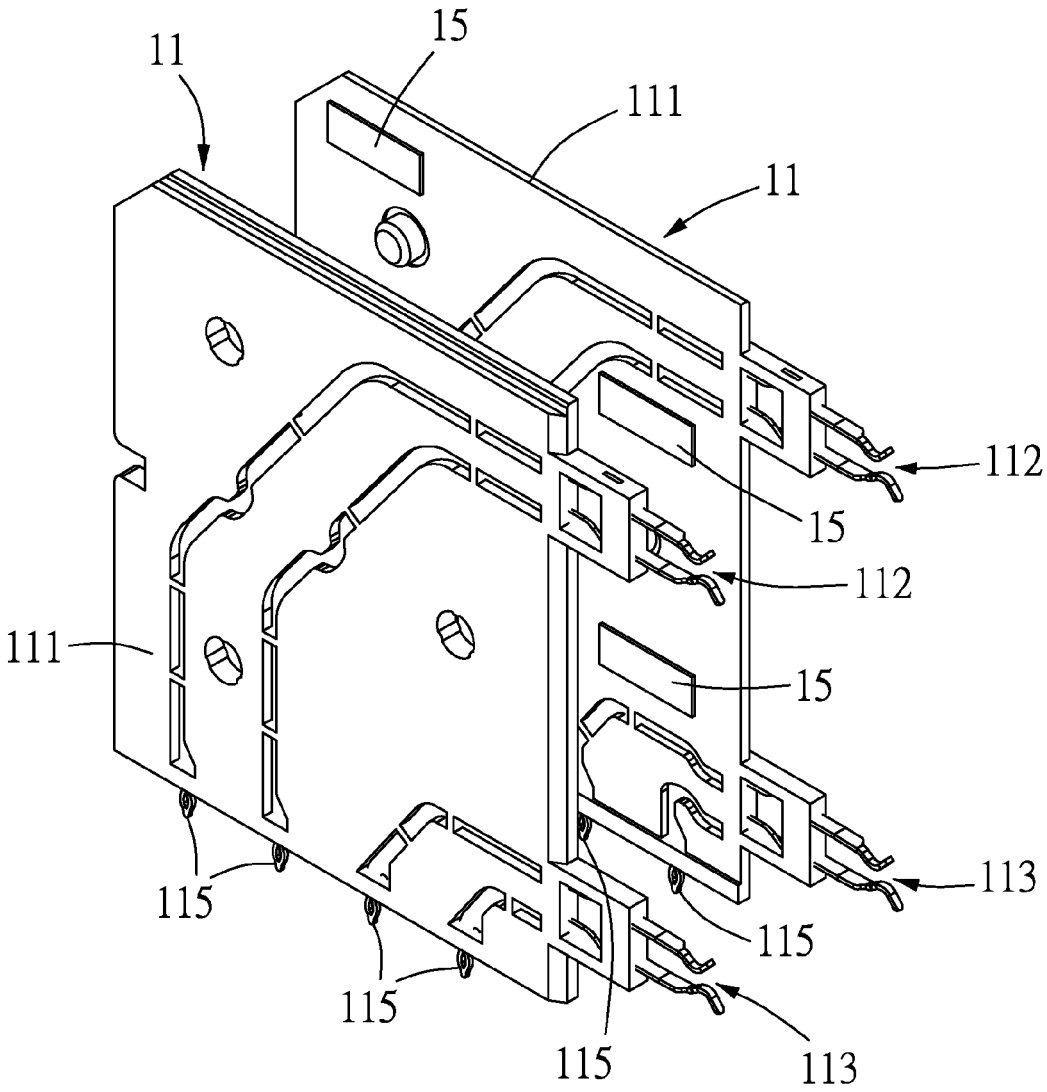

FIG.7

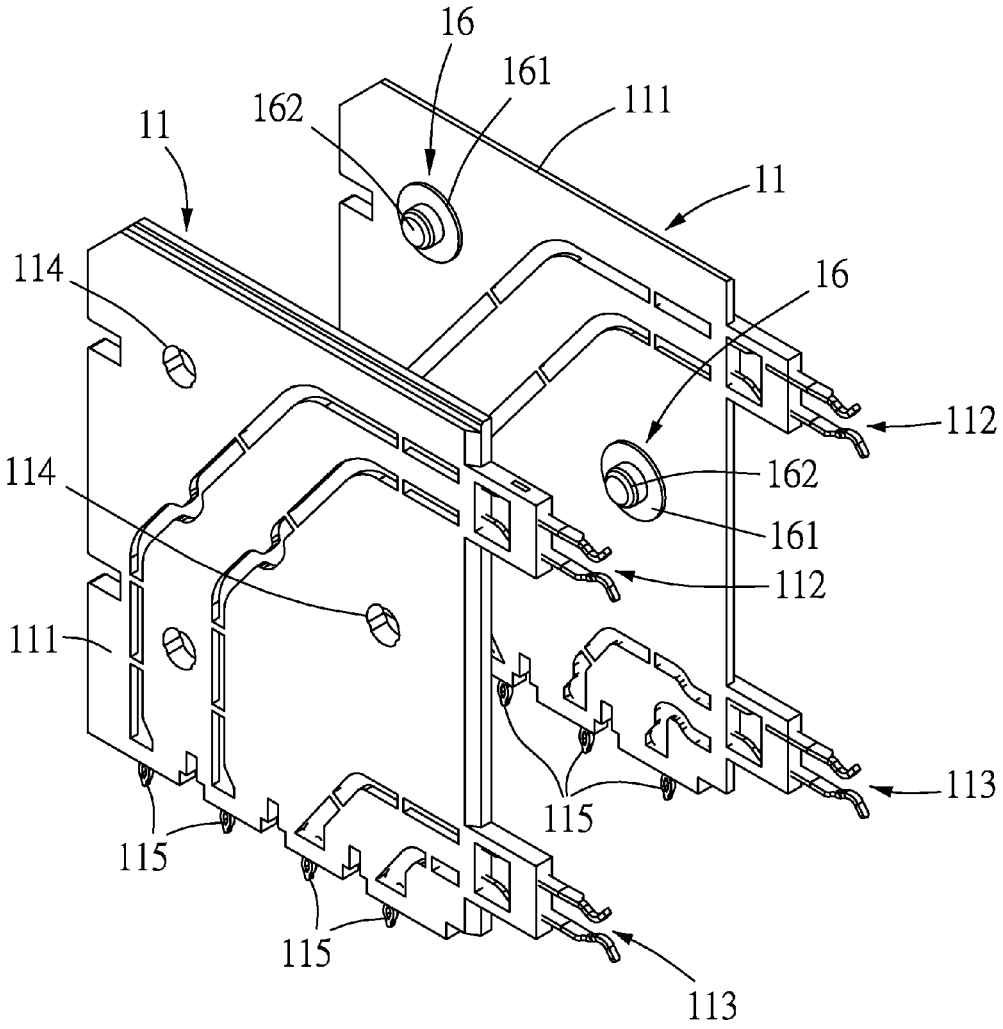
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FIG.8

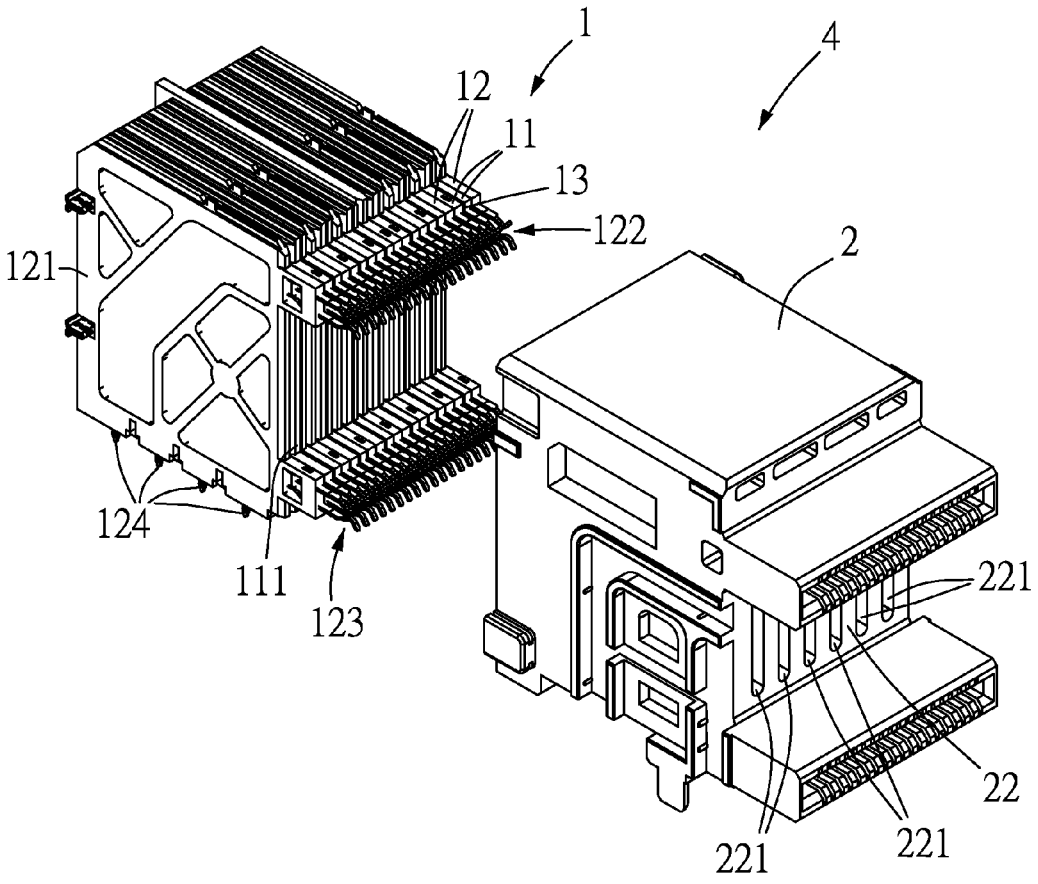

FIG.9

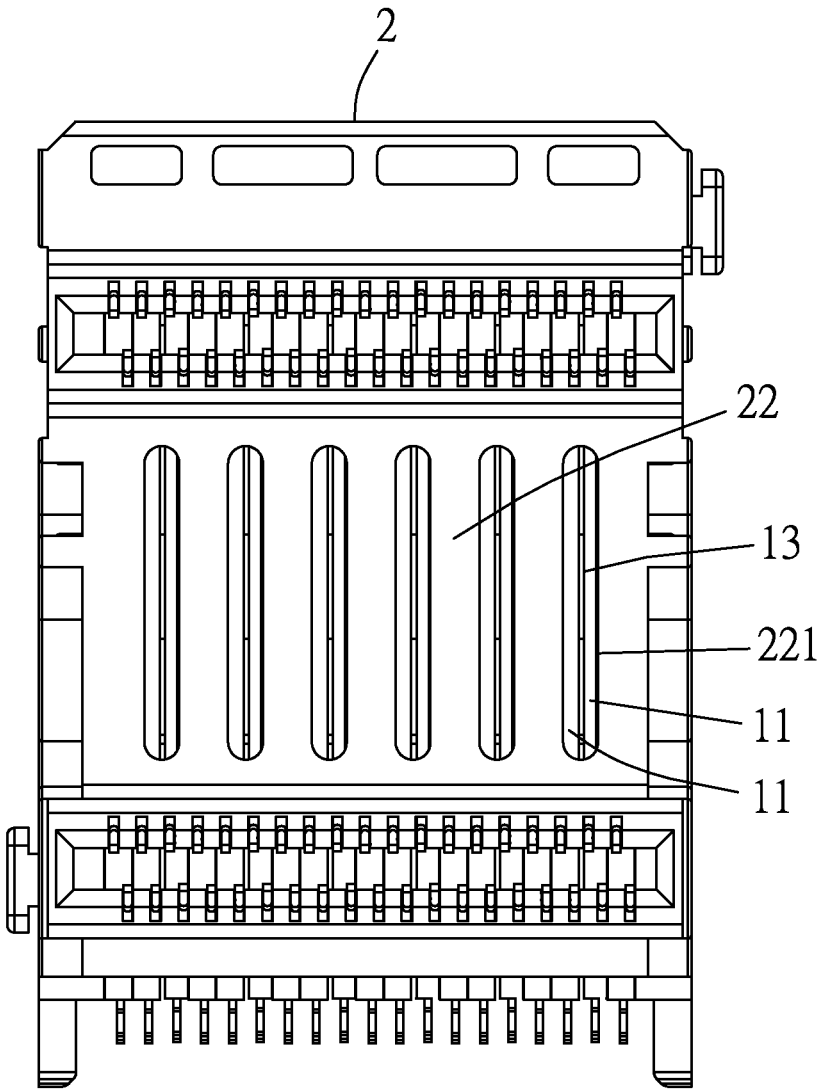

FIG.10

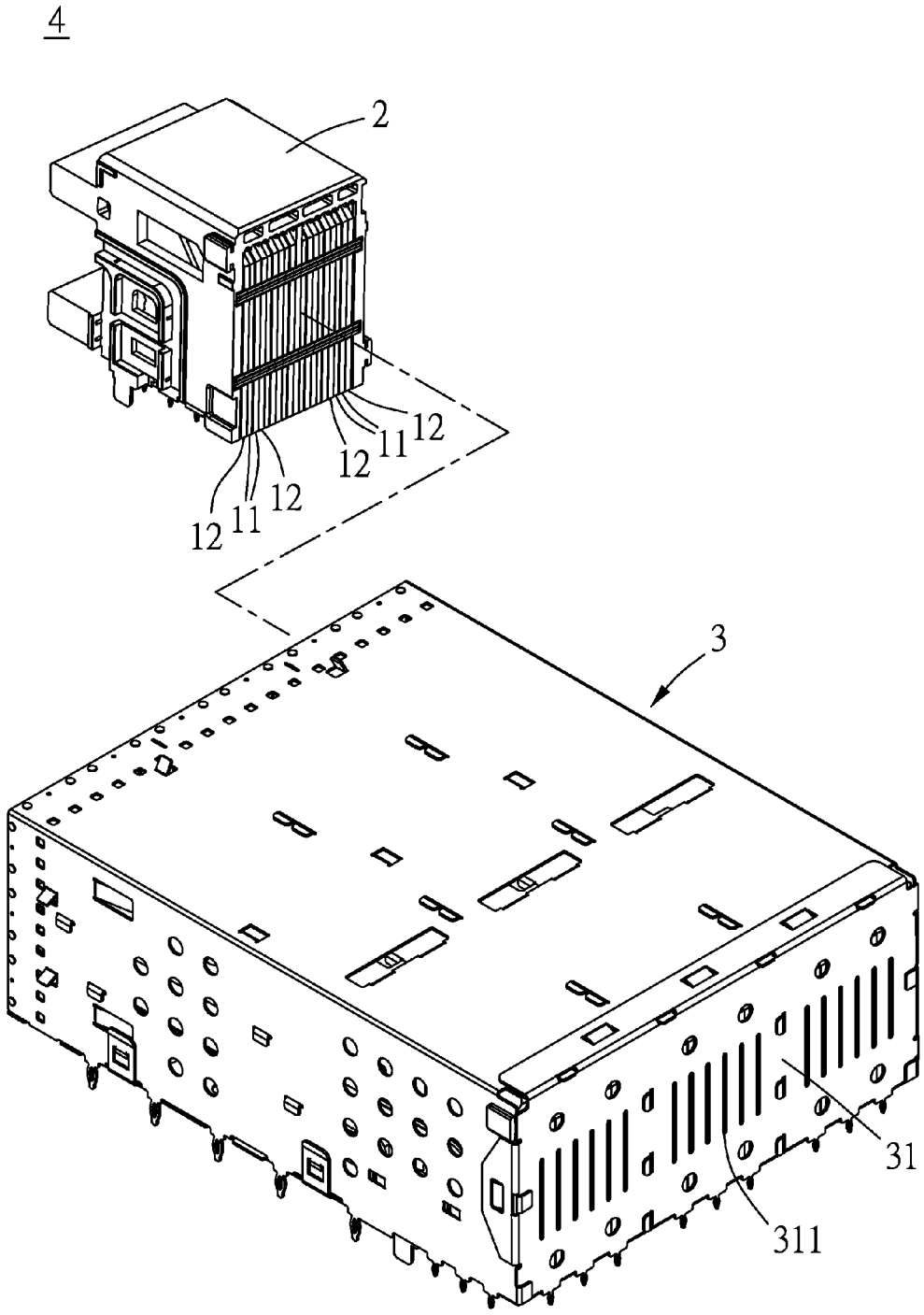

FIG.11

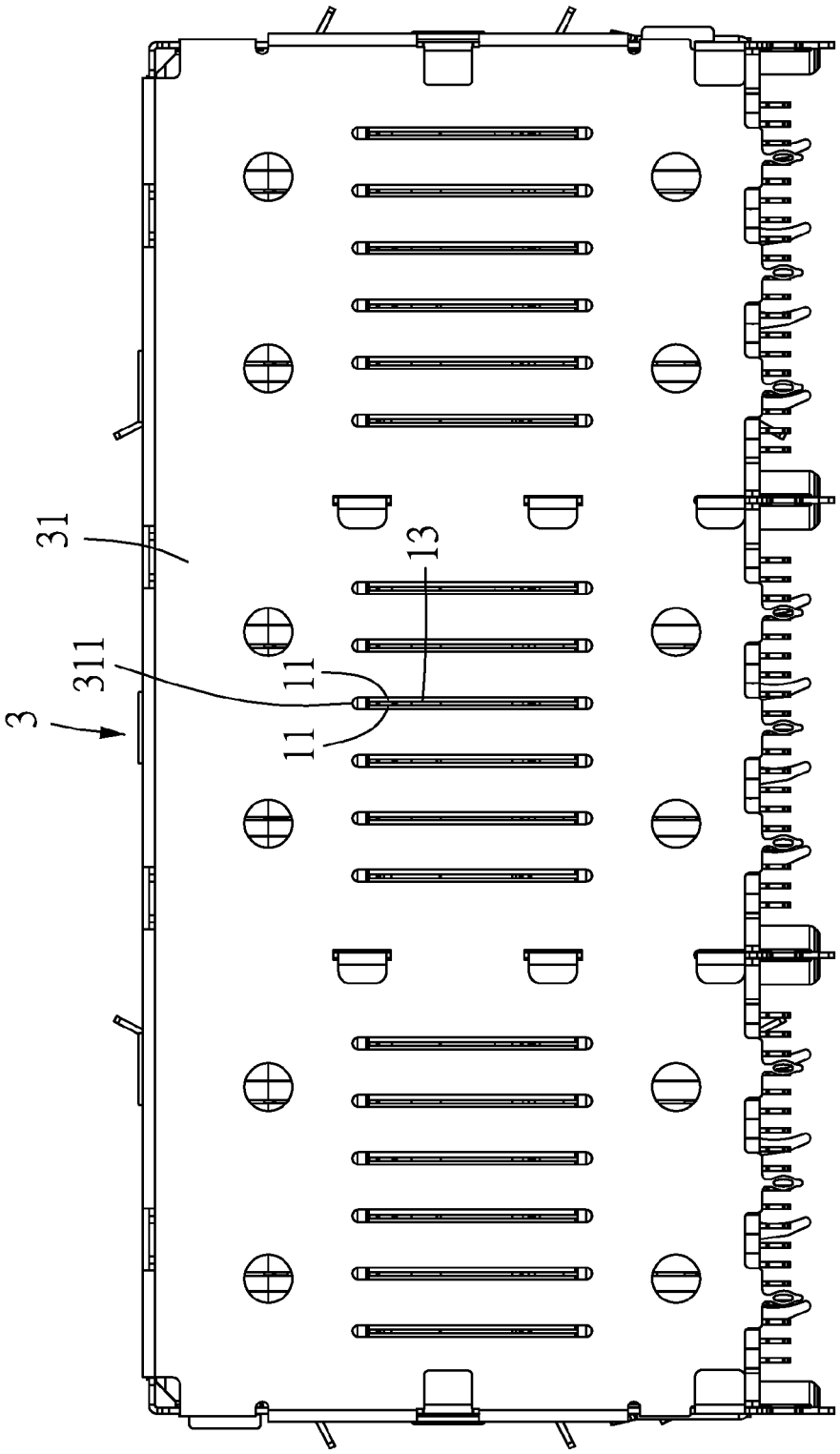

FIG.12

TERMINAL PLATE SET AND ELECTRIC CONNECTOR INCLUDING THE SAME

FIELD OF THE INVENTION

The present invention relates to a terminal plate set and an electric connector including the terminal plate set, in particular to the terminal plate set and the electric connector capable of adjusting the impedance of a signal terminal plate and a grounding terminal plate to the best range and improving the heat dissipation efficiency of the terminal plate set and the electric connector.

BACKGROUND OF THE INVENTION

In general, a computer and an electronic device come with various kinds of electric connectors for connecting the computer and the electronic device. The electric connector generally has two signal terminal plates installed between two grounding terminal plates. However, the signal terminal plates and the grounding terminal plates of the electric connector are arranged closely with each other, so that the effective dielectric coefficients of the signal terminal plates and the grounding terminal plates of the electric connector become relatively higher, and the electric connector has a greater power loss. Since the signal terminal plates and the grounding terminal plates of the electric connector are arranged closely with each other, air cannot flow easily between the signal terminal plates and the grounding terminal plates of the electric connector, and the heat generated by the signal terminal plates and the grounding terminal plates of the electric connector cannot be dissipated easily, and the heat dissipation efficiency of the electric connector is lowered.

Therefore, it is a main subject of the present invention to provide a terminal plate set and an electric connector including the terminal plate set, wherein the impedance of the signal terminal plates and the grounding terminal plates can be adjusted to the best range to improve the heat dissipation efficiency of the terminal plate set and the electric connector.

SUMMARY OF THE INVENTION

In view of the drawbacks of the prior art, the inventor of the present invention based on years of experience in the related industry to conduct extensive researches and experiments, and finally developed a terminal plate set and an electric connector including the terminal plate set, in hope of adjusting the impedance of the signal terminal plate and the grounding terminal plate to the best range and improving the heat dissipation efficiency of the terminal plate set and the electric connector.

To achieve the aforementioned and other objectives, a first mode of the present invention provides a terminal plate set comprising two signal terminal plates, and two grounding terminal plates, and the signal terminal plates are parallel to each other and disposed between the grounding terminal plates, and a partition channel is formed between the signal terminal plates, between the signal terminal plate and the grounding terminal plate, or between the terminal plates.

In the terminal plate set, at least one spacer plate is installed between the signal terminal plates, between the signal terminal plate and the grounding terminal plate, or between the terminal plates to form the partition channel.

The terminal plate set further comprises at least one spacing protrusion, and the spacing protrusion has a spacer plate and a positioning protrusion coupled to each other, and the spacer plate is installed between the signal terminal plates, between the signal terminal plate and the grounding terminal plate, or between the terminal plates to form the partition channel, and the positioning protrusion is plugged to the signal terminal plate or the grounding terminal plate.

In the terminal plate set, an upper spacer is installed between the upper edges of the signal terminal plates, between the upper edge of the signal terminal plate and the upper edge of the grounding terminal plate, or between the upper edges of the terminal plates, or a lower spacer is installed between the lower edges of the signal terminal plates, between the lower edge of the signal terminal plate and the lower edge of the grounding terminal plate, or between the lower edges of the terminal plates to form the partition channel.

In the terminal plate set, the partition channel has a width greater than 0.05 mm.

A second mode of the present invention is an electric connector including at least one terminal plate set of the first mode and a front body, wherein the terminal plate set is installed at the front body, and at least one front convection hole is formed on a plug side of the front body.

In the electric connector, the quantity and position of the front convection hole are corresponsive to those of the partition channel.

The electric connector further comprises a rear body, the front body and the terminal plate set installed at the rear body, and at least one rear convection hole is formed on a rear wall of the rear body.

In the electric connector, the quantity and position of the rear convection hole are corresponsive to those of the partition channel.

The terminal plate set and the electric connector of the present invention can adjust the impedance of the signal terminal plate and the grounding terminal plate to the best range and improve the heat dissipation efficiency of the terminal plate set and the electric connector.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a first schematic view of a first preferred embodiment of the present invention;

FIG. **2** is a second schematic view of the first preferred embodiment of the present invention;

FIG. **3** is a third schematic view of the first preferred embodiment of the present invention;

FIG. **4** is a fourth schematic view of the first preferred embodiment of the present invention;

FIG. **5** is a fifth schematic view of the first preferred embodiment of the present invention;

FIG. **6** is a sixth schematic view of the first preferred embodiment of the present invention;

FIG. **7** is a schematic view of a spacer plate of the first preferred embodiment of the present invention;

FIG. **8** is a schematic view of a spacing protrusion of the first preferred embodiment of the present invention;

FIG. **9** is a schematic view of a terminal plate set and a front body of a second preferred embodiment of the present invention;

FIG. **10** is a schematic view of a front convection hole of the second preferred embodiment of the present invention;

FIG. **11** is a schematic view of a terminal plate set, a front body and a rear body of the second preferred embodiment of the present invention; and

FIG. **12** is a schematic view of a rear convection hole of the second preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The objects, characteristics and effects of the present invention will become apparent with the detailed description of the preferred embodiments and the illustration of related drawings as follows.

With reference to FIGS. **1** to **7** for the schematic views of the first to sixth preferred embodiment of the present invention, and a schematic view of a spacer plate in accordance with the present invention respectively, a first mode of the invention comprises a terminal plate set **1** or a plurality of terminal plate sets **1** arranged parallel to one another. The terminal plate set **1** comprises two signal terminal plates **11** and two grounding terminal plates **12** as shown in FIG. **1**, and the terminal plates **11**, **12** have a conductive terminal (not shown in the figure) and a covering plate **111**, **121** respectively, and the covering plates **111**, **121** are covered onto the conductive terminals to prevent the conductive terminals from being short circuited by touching with each other and provide an effective insulation of the conductive terminals. An upper conductive flip pair **112**, **122** and a lower conductive flip pair **113**, **123** of the conductive terminal are exposed from the front side of the covering plate **111**, **121**, and four conductive pins **115**, **124** of the conductive terminal are exposed from the bottom side of the covering plate **111**, **121**, and the conductive pins **115**, **124** are corresponsive to the upper conductive flip pair **112**, **122** and the lower conductive flip pair **113**, **123** respectively. The upper conductive flip pair **112**, **122** and the lower conductive flip pair **113**, **123** are provided for connecting an external electronic device (not shown in the figure), and the conductive pins **115**, **124** are soldered onto a circuit board (not shown in the figure). Wherein, the signal terminal plates **11** are parallel to each other and disposed between the grounding terminal plates **12**, and a partition channel **13** is disposed between the signal terminal plates **11** as shown in FIGS. **1** and **2** (wherein FIG. **1** shows the top view), or a partition channel **14** is disposed between the signal terminal plate **11** and the grounding terminal plate **12** as shown in FIGS. **3** and **4** (wherein FIG. **3** shows a partial blow-up view), or a partition channel **13**, **14** is disposed between the terminal plates **11**, **12** as shown in FIGS. **5** and **6** (wherein FIG. **5** shows a partial blow-up view). When the terminal plates **11**, **12** are arranged closely with each other, the partition channel **13**, **14** can be formed between the signal terminal plates **11**, between the signal terminal plate **11** and the grounding terminal plate **12**, or between the signal terminal plates **11** and between the signal terminal plate **11** and the grounding terminal plate **12** at the same time. When the terminal plates **11**, **12** are arranged closely with each other, the partition channel **13**, **14** can be formed by reducing the thickness of the signal terminal plate **11**, or reducing the thickness of the grounding terminal plate **12**, or reducing the thickness of the signal terminal plate **11** and the thickness of the grounding terminal plate **12** at the same time.

The electric field generated by the conductive terminals in the partition channel **13**, **14**, the signal terminal plate **11** or the grounding terminal plate **12** can be passed through the partition channel **13**, **14** (or the air in the partition channel **13**, **14**) to decrease the effective dielectric coefficient of the conductive terminal, so that the conductive terminals (of the signal terminal plate **11** or the grounding terminal plate **12**) have the best range of impedance to reduce the power loss of the conductive terminals (of the signal terminal plate **11** or the grounding terminal plate **12**).

In FIG. **7**, at least one spacer plate **15** of the terminal plate set can be installed between the signal terminal plates **11**, between the signal terminal plate **11** and the grounding terminal plate **12**, or between the terminal plates **11**, **12** to form the partition channel **13**, **14**.

With reference to FIG. **8** for a schematic view of a spacing protrusion of the first preferred embodiment of the present invention, the terminal plate set further comprises at least one spacing protrusion **16**, and the spacing protrusion **16** has a spacer plate **161** and a positioning protrusion **162** coupled to each other. The spacer plate **161** can be installed between the signal terminal plates **11**, between the signal terminal plate **11** and the grounding terminal plate **12**, or between the terminal plates **11**, **12** to form the partition channel **13**, **14**. The positioning protrusion **162** can be plugged into a penetrating hole **114** (or a concave hole) of the signal terminal plate **11** or the grounding terminal plate **12**, and the positioning protrusion **162** is provided for fixing the signal terminal plates **11** at positions corresponding to each other, fixing the signal terminal plate **11** and the grounding terminal plate **12** at positions corresponding to each other, or fixing the terminal plates **11**, **12** at positions corresponding to each other.

In FIG. **5**, an upper spacer **21** of the terminal plate set can be installed between the upper edges of the signal terminal plates **11**, between the upper edge of the signal terminal plate **11** and the upper edge of the grounding terminal plate **12**, or between the upper edges of the terminal plates **11**, **12** to form the partition channel **13**, **14**. In addition, a lower spacer (similar to the upper spacer, and not shown in the figure) can be installed between the lower edges of the signal terminal plates **11**, between the lower edge of the signal terminal plate **11** and the lower edge of the grounding terminal plate **12**, or between the lower edges of the terminal plates **11**, **12** to form the partition channel **13**, **14**. The upper spacer **21** (or the lower spacer) can be a spacer block or strip installed at the top (or bottom) of an inner wall of the front body **2**.

In the terminal plate set, the partition channel **13**, **14** has a width greater than 0.05 mm.

With reference to FIG. **9** for a schematic view of a terminal plate set and a front body of the second preferred embodiment of the present invention, a second mode of the present invention is an electric connector **4** comprising at least one of the terminal plate set **1** of the first mode and a front body **2**, and the front body **2** can be made of plastic and the rear side and the bottom side of the front body **2** can have openings, and a plug side **22** of the front body **2** has at least one front convection hole **221**, and the terminal plate set **1** can be installed into the front body **2** from the rear side of the front body **2**.

By the partition channel **13**, **14** and the front convection hole **221**, outside air can flow from the front convection hole **221** through the partition channel **13**, **14** to the rear side of the front body **2** to dissipate the waste heat generated by the terminal plate sets **1** and provide an effective heat dissipation of the signal terminal plate **11** or the grounding terminal plate **12** of the electric connector **4**, so as to improve the heat dissipation efficiency of the electric connector **4**.

With reference to FIG. **10** for a schematic view of a front convection hole of the second preferred embodiment of the present invention, the quantity and position of the front convection hole **221** of the electric connector are corresponsive to those of the partition channel **13**, **14**, so that air can flow smoothly to improve the heat dissipation efficiency of the electric connector **4**.

With reference to FIG. **11** for a schematic view of a terminal plate set, a front body and a rear body of the second preferred embodiment of the present invention, the electric connector further includes a rear body **3**, and the rear body **3** can be made of metal and whose front side and bottom side have openings, and at least one rear convection hole **311** is

formed on a rear wall **31** of the rear body **3**, and the front body **2** and the terminal plate set **1** can be installed into the rear body **3** from the front side of the rear body **3**. By the partition channel **13**, **14**, the front convection hole **221** and the rear convection hole **311**, outside air can pass from the front convection hole **221** into the rear convection hole **311** through the partition channel **13**, **14** to dissipate the waste heat generated by the terminal plate sets **1**, so that the signal terminal plate **11** or the grounding terminal plate **12** of the electric connector **4** provides an effective cooling effect to improve the heat dissipation efficiency of the electric connector **4**.

With reference to FIG. **12** for a schematic view of a rear convection hole of the second preferred embodiment of the present invention, the quantity and position of the rear convection hole **311** of the electric connector are corresponsive to those of the partition channel **13**, **14**, so that air can flow smoothly to further improve the heat dissipation efficiency of the electric connector **4**.

While the invention has been described by means of specific embodiments, numerous modifications and variations could be made thereto by those skilled in the art without departing from the scope and spirit of the invention set forth in the claims.

What is claimed is:

1. A terminal plate set, comprising:

two signal terminal plates;

two grounding terminal plates, wherein the signal terminal plates and the grounding terminal plates are parallel to each other and the signal terminal plates are disposed between the grounding terminal plates, and a partition channel is disposed between the signal terminal plates, between the signal terminal plate and the grounding terminal plate, or between the signal terminal plates and the grounding terminal plates; and

at least one spacing protrusion, having a spacer plate and a positioning protrusion coupled to each other, and the spacer plate being installed between the signal terminal plates, between the signal terminal plate and the grounding terminal plate, or between the signal terminal plates and the grounding terminal plates to form the partition channel, and the positioning protrusion being inserted into the signal terminal plate or the grounding terminal plate.

2. The terminal plate set of claim **1**, further comprising an upper spacer disposed between the upper edges of the signal terminal plates, between the upper edge of the signal terminal plate and the upper edge of the grounding terminal plate, or between the upper edges of the signal terminal plates and the grounding terminal plates, or a lower spacer disposed between the lower edges of the signal terminal plates, between the lower edge of the signal terminal plate and the lower edge of the grounding terminal plate, or between the lower edges of the signal terminal plates and the grounding terminal plates to form the partition channel.

3. The terminal plate set of claim **1**, wherein the partition channel has a width greater than 0.05 mm.

4. An electric connector, including at least one terminal plate set and a front body, and the terminal plate set being installed at the front body, and at least one front convection hole being formed on a plug surface of the front body;

wherein the terminal plate set comprises two signal terminal plates and two grounding terminal plates, the signal terminal plates and the grounding terminal plates are parallel to each other and the signal terminal plates are disposed between the grounding terminal plates, and a partition channel is disposed between the signal terminal plates, between the signal terminal plate and the grounding terminal plate, or between the signal terminal plates and the grounding terminal plates, and the quantity and position of the front convection hole correspond to those of the partition channel.

5. The electric connector of claim **4**, further comprising a rear body, and the front body and the terminal plate set being disposed at the rear body, and at least one rear convection hole being formed on a rear wall of the rear body.

6. The electric connector of claim **5**, wherein the quantity and position of the rear convection holes are corresponsive to the quantity and position of the partition channels.

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